UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KOZO NAKAMURA, TOSHIAKI SAISHOJI,
TAKASHI YOKOYAJMA, SHIN MATSUKUMA, and FUMITAKA ISHIKAWA

Appeal 2006-2914
Application 09/856,209
Technology Center 1700

Decided: September 18, 2006

Before KIMLIN, GARRIS, and PAK, *Administrative Patent Judges*.

KIMLIN, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 17-20. Claim 17 is illustrative:

17. A method of producing a silicon ingot, comprising:

producing a silicon single crystal ingot having 60% or more GOI C mode yield and being prevented from generating of dislocation clusters under the following conditions:

(1) $1.15 \leq (G1_{edge}/G1_{center}) \leq 1.25$;

(2) $0.5 < (\text{OSF ring inner diameter/crystal diameter}) < 1.06 \times (G1_{center} \times G2_{center})^{-0.2}$ where

$G1_{center}$ is a temperature gradient in the axial direction at the crystal center in the temperature region from the solid-liquid interface temperature to approximately 1350°C, $G1_{edge}$ is a temperature gradient in the axial direction at the crystal edge in the temperature region from the solid-liquid interface temperature to approximately 1350°C, $G2_{center}$ is a temperature gradient in the axial direction at the crystal center near 1120°C.

The Examiner relies upon the following reference as evidence of obviousness:

Iida	US 5,968,264	Oct. 19, 1999

Appellants' claimed invention is directed to a method of producing a silicon ingot by the Czochralski method that has a gate oxide integrity (GOI) of 60 percent or more. The silicon ingot is produced under the recited conditions for the ratio of the temperature gradient in the axial direction at the crystal center to the temperature gradient in the axial direction at the crystal edge, and for the ratio of the OSF ring inner diameter to the crystal diameter (OSF is an acronym for ring-shape oxidation-induced stacking faults). Appellants acknowledge that it was "known that the position of the OSF ring is influenced by the temperature gradient within the crystal in the pulling axis direction (this changes with the position in the crystal radial direction)" (spec. 2, 3rd para.). Appellants also acknowledge that it was known that "by adjusting the relation between the crystal growth speed and the temperature gradient within the crystal in the pulling axis direction such that the ratio is within a special range, defect free single crystals not containing growth

defects were obtained" (spec. 2, last para.). According to the present invention, "by raising the pulling speed, a state can be achieved in which the efficiency of production of the perfect crystal part is in fact improved, when converted into per unit time" (spec. 4, 2nd para.).

Appealed claims 17-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iida.

Appellants have not separately argued any particular claim on appeal. Accordingly, all the appealed claims stand or fall together with claim 17.

We have thoroughly reviewed each of Appellants' arguments for patentability. However, we are in complete agreement with the Examiner that the claimed subject matter would have been obvious to one of ordinary skill in the art within the meaning of Section 103 in view of the applied prior art. Accordingly, we will sustain the Examiner's rejection for the reasons set forth in the Answer, which we incorporate herein, and we add the following for emphasis only.

Iida, like Appellants, discloses a process for utilizing the Czochralski method for producing a silicon ingot at high productivity with a very low defect density over the entire cross-section. Also like Appellants, Iida obtains the low defect density by controlling the temperature gradient difference at the edge and center of the crystal, as well as the pulling speed. While Appellants contend that Examples 1and 2 of the reference show a delta G of 3.0 degrees C/cm, this numerical difference in the reference temperature gradients does not represent the *ratio* of the temperature gradients at the center and edge of the crystal. Appellants have not refuted the Examiner's factual determination that Figure 8 of the reference shows a temperature gradient of 35 degrees C/cm at the edge of the

crystal and a temperature gradient of 30 degrees C/cm at the center of the crystal, which yields a ratio of temperature gradient at the edge/temperature gradient at the center of approximately 1.166, which value is within the claimed range.

As for claimed condition (2), the ratio of OSF ring inner diameter/crystal diameter, there is no dispute that Iida "teaches an OSF ring with an inner diameter of at least ½ a wafer inner diameter (Fig 10A) at a pulling speed of 0.62 mm/min." (Answer 3, penultimate sent.). It is Appellants' contention that Iida does not teach the claimed upper limit for the ratio. However, Appellants have not refuted the Examiner's factual finding that Iida "discloses ratios of OSF ring diameter to crystal diameter from 0.5 to about 1" (Answer 4, 1st para.). Nor have Appellants rebutted the Examiner's rationale that Iida's "ingot formed by varying pulling rate will necessarily have a portion within the claimed range for the OSF ring" (Answer 5, 1st para.). As explained by the Examiner, since it was known in the art that the diameter of the OSF ring is dependent on the pulling speed, and Iida teaches changing the pulling speed during ingot formation, the ingot of Iida "will necessarily be formed with an OSF ring diameter within the claimed range . . . because the OSF ring gradually changes from 0.1" (*id.*) .

It is well settled that when, as here, the claimed process reasonably appears to be substantially the same as a process disclosed by the prior art, the burden is on the Applicant to prove that the prior art process does not necessarily or inherently possess characteristics attributed to the claimed process. *In re Spada*, 911 F.2d 705, 708, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990); *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); *In re Fitzgerald*, 619 F.2d 67, 70, 205

USPQ 594, 596 (CCPA 1980). In the present case, Appellants have not factually established on this record that methods within the scope of the appealed claims produce silicon ingots that are substantially different than silicon ingots produced by methods fairly taught by Iida. In the absence of such evidence, the Examiner's prima facie case of obviousness stands unrebutted.

In conclusion, based on the foregoing and the reasons well-stated by the Examiner, the Examiner's decision rejecting the appealed claims is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED

WELSH & KATZ, LTD
120 S RIVERSIDE PLAZA
22ND FLOOR
CHICAGO, IL 60606

ECK:hh